

CAMBRIAN INTRUSION-RELATED COPPER MINERALISATION AT THE THOMAS CREEK PROSPECT, SOUTHWESTERN TASMANIA



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By

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A thesis submitted in partial fulfillment of the
requirements for the degree of Masters of Economic Geology



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University of Tasmania,
July, 2001.

ABSTRACT

The Thomas Creek Prospect lies at the southern end of the Sorell Peninsula, western Tasmania and consists of intrusions believed to be coeval with copper mineralisation within a dioritic intrusive complex. The prospect is hosted by the Noddy Creek Volcanics, which are geochemically correlated to the calc-alkaline Mt Read Volcanics.

Widespread (600 by 400 m) but low grade copper mineralisation is hosted by diorites and feldspar-augite porphyritic andesite intrusions, which have been intruded by chalcopyrite-bearing porphyritic micromonzodiorites. Early disseminated magnetite, pyrite and chalcopyrite formed prior to and synchronous with pervasive feldspar-silicate alteration. Various chalcopyrite-bearing vein generations (actinolite, tourmaline, K-feldspar - smectite, epidote and carbonate) have overprinted the early-formed magnetite and feldspar-silicate alteration assemblages.

The "immobile" elements (Ti and P) were mostly mobilised during the formation of pervasive K-feldspar hydrothermal alteration at Thomas Creek. A subset of the geochemical data set exhibits coherent behaviour, indicating that the diorites and porphyritic micromonzodiorites form a co-magmatic fractionation series. Coherent behaviour of Ba, Rb, Sr and K_2O has been recognised for the igneous suite. Both primary and secondary K-feldspar appear to be intrusion-related. Fe, S, P, Zn and Cu appear to have been lost during fractionation due to devolatilisation of the micromonzodiorite magmas.

Sulphur isotope values of sulphides at Thomas Creek range from -4.9 to 11.5‰. Sulphides in the early formed magnetite and feldspar-silicate alteration assemblages have similar $\delta^{34}S$ ranges (5.3 to 9.3‰). The isotopic range in the porphyritic micromonzodiorites (8.2 to 11.5‰) is believed to have formed in response to fractionation and devolatilisation of ^{32}S -rich hydrothermal fluids, resulting in isotopically lighter signatures (-4.9 to 7.7‰) in veins related to the intrusions. Sulphur

isotope geothermometry, utilising co-existing pyrite-chalcopyrite pairs, indicates mineralisation temperatures in veins ranged from 254 to 611°C.

Four stages of mineralisation have been recognised at Thomas Creek: 1:- early magnetite and feldspar-silicate alteration; 2:- emplacement of Cu-bearing micromonzodiorite intrusions and precipitation of coeval actinolite and tourmaline veins; 3:- K-feldspar - smectite vein formation; and 4:- epidote and carbonate veining. Phases 1 and 2 represent periods of magma emplacement with some mixing of magmatic-hydrothermal water with seawater-derived fluid. Phase 3 veins appear to be of magmatic character, with minimal seawater influence. Phase 4 probably represents final incursion of seawater-derived fluids as the magmatic system waned.

Thomas Creek can be correlated to Mt Lyell copper-gold mineralisation, based on similarity of sulphur isotope distribution and ore mineralogy. Mineralisation at the Thomas Creek Prospect is believed to represent the root zone of a Mt Lyell-type hydrothermal system. There are also some similarities with the alkaline porphyry Cu-Au deposits of British Columbia, with Thomas Creek possibly being the submarine analogue of a porphyry system formed in a back arc environment.

ACKNOWLEDGEMENTS

The author wishes to thank all that have expressed interest and provided encouragement during the writing of this thesis. Special thanks are extended to Jessica Farley and my supervisor David Cooke, both of whom assisted with many aspects of this thesis. Thanks are also extended to Tony Crawford for reviewing my geochemistry chapter.

Finally, I am grateful to Plutonic Operations Ltd for covering analytical costs and providing access to the Thomas Creek Prospect. Bob Close deserves special thanks for organising this support and encouragement during write up. I am also grateful to Jackie Sexton from Plutonic's Sydney office who forwarded original drafts for drill sections and various digital figure templates.

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